

# Claims

[c1] What is claimed is:

1. Connectable tool joints adapted for electrical transmission, comprising:

a plurality of threads intermediate primary and secondary shoulders;

the tool joints further comprising a cross-sectional area adjacent their respective secondary shoulders that acts cooperatively to withstand an overload condition of the connected tool joints;

an opening within the cross-sectional area adjacent the secondary shoulder comprising a volume that is 50% or less than what is required to fail the secondary shoulder adjacent the opening during an overload condition of the tool joint; and

wherein, the respective openings are adapted to receive electrical transmission elements, and when the tool joints are connected, the respective elements are substantially aligned to enable electrical transmission across the connected tool joints.

[c2] 2. The tool joints of claim 1 comprising a pin end tool joint.

- [c3] 3. The tool joints of claim 1 comprising a box end tool joint.
- [c4] 4.The tool joints of claim 1, wherein the secondary shoulder comprises a pin end within the pin end tool joint.
- [c5] 5.The tool joints of claim 1, wherein the secondary shoulder comprises an internal secondary shoulder within the box end tool joint.
- [c6] 6.The tool joints of claim 1 connected to a tubular downhole tool selected from the group consisting of tools that make up a drill string for drilling oil, gas, and geothermal wells.
- [c7] 7.The tool joints of claim 1, wherein the cross-sectional area adjacent the secondary shoulders acts cooperatively with the threads to withstand an overload condition of the tool joint.
- [c8] 8.The tool joints of claim 1, wherein the openings comprise an annular trough.
- [c9] 9.The tool joints of claim 1, wherein the openings comprise a buttressed annular trough.
- [c10] 10.The tool joints of claim 1, wherein the openings in-

tersect a passageway leading to the interior of a down-hole tool selected from the group consisting of tools that make up a drill string for drilling oil, gas, and geothermal wells.

- [c11] 11. The tool joints of claim 1, wherein the electrical transmission comprises data.
- [c12] 12. The tool joints of claim 1, wherein the electrical transmission comprises power.
- [c13] 13. The tool joints of claim 1, wherein the electrical transmission elements comprise a magnetic inductive transmission system.
- [c14] 14. The tool joints of claim 1, wherein the transmission elements comprise a direct contact electrical system.
- [c15] 15. The tool joints of claim 1, wherein the transmission elements comprise a Hall Effect system.
- [c16] 16. The tool joints of claim 1, wherein the transmission elements comprise a combination of inductive and direct contact systems.
- [c17] 17. The tool joints of claim 1, wherein the transmission elements are in communication with subterranean and surface equipment.

- [c18] 18. The tool joints of claim 1, wherein the overload condition comprises a torsional load exceeding one-half the yield strength of the tool joints.
- [c19] 19. The tool joints of claim 1, wherein the failure of the secondary shoulder adjacent the opening comprises a deformation of at least a portion of the opening.
- [c20] 20. Connectable tool joints adapted for electrical transmission, comprising:  
a plurality of threads intermediate primary and secondary shoulders;  
the tool joints further comprising a cross-sectional area adjacent their respective secondary shoulders that act cooperatively to withstand an overload condition of the connected tool joints;  
an opening within the cross-sectional area adjacent the secondary shoulder comprising a maximum volume that is less than what is required to fail the secondary shoulder adjacent the opening during an overload condition of the tool joint; and  
wherein, the respective openings are adapted to receive electrical transmission elements, and when the tool joints are connected, the respective elements are substantially aligned to enable electrical transmission across the connected tool joints.